

## Re: recombination question

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*Source:* <http://sci.tech-archive.net/Archive/sci.bio.evolution/2006-10/msg00091.html>

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  - *Date:* Thu, 12 Oct 2006 00:22:01 -0400 (EDT)
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Jeremy Targett wrote:

A question that I'm sure someone here can answer for me:

In my basic understanding of genetic recombination, two chromosomes recombine with crossings at essentially random locations in the DNA sequence. Most of the crossing points, if selected randomly, occur in long stretches of DNA that do not code for anything in particular, and may well be junk for all we know. But the tiny bands along the chromosome that contain genes are not vanishingly small and in fact sometimes a crossing point must occur within a gene. When that happens, if the two chromosomes have different alleles at that point in the DNA sequence, the resulting gene will be a mash-up of the original two, which I would guess is very unlikely to work.

Homologous recombination that occurs during meiosis does not "mash up" anything. Just parts are switched. In any two members of a species the genes are nearly identical and recombination just swaps out the sequence of one chromosome for the nearly identical sequence of another.

Say you have a sequence: ACGTTAACGAGAGTCGG on one chromosome and on the homologue the sequence was acattaacgagagccgg and a recombination event occurred in the middle of the sequence you would get one recombinant product like ACGTTAACGAgagccgg and the other acattaacgaGAGTCGG

My questions are:

does what I described actually happen or does something prevent crossover within certain segments – and that's why genes have such longevity?

Crossovers occur within genes. Look up MHC genes and recombinants in humans and you should pick up a couple of papers. The old literature

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on yeast is full of detecting recombinants within genes between two mutants that restore function of the gene because the mutations are in different parts of the gene.

Genes do not have longevity because of the recombination that doesn't occur in them. Recombinants can either be selected for or against just like new mutations.

If it does happen, what are the usual consequences? Does the individual usually die?

No.

How likely is it that a random crossover point in the DNA sequence falls within a gene, rather than in the stuff between genes along the chromosome?

In yeast recombination within genes is quite common because a centiMorgan (1% recombination) is around 3 kb? less? I can't recall. The average protein coding gene is around 1 kb of coding sequence along with introns. In humans 1 centiMorgan is about a megabase, but some genes like the Duchennes muscular dystrophy gene are more than a megabase in length.

How many crossover points do there tend to be per chromosome, roughly, in human recombination?

Nearly all chromosomes are over 50 centiMorgans in length (I can't think of an example of one shorter than 50 cM. This is recombination distance and not base-pair length of the chromosome). During Meiosis at least one recombination event occurs on a chromosome during pairing. It can be resolved so that a recombination occurs or the resolution can just have the a little gene conversion with no recombination of the parts of the two chromosomes. I don't know if it is still going around, but the claim was that recombination might be required for accurate pairing of the homologs. Big chromosomes can be several hundred centiMorgans in length.

There are hotspots of recombination where the frequency of recombination is much higher. Recombination rates can be different on different chromosomes within a cell. In chickens there are macro chromosomes and smaller chromosomes called micro chromosomes. 1 centiMorgan averages out to around 300,000 bp on the macro chromosomes, but only 50,000 bp on the microchromosomes.

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as you can see I have only a very elementary understanding of this, I'm a musician whose wife is taking elementary biology and I was just looking at her textbook trying to understand this! Thanks for any answers.

No one is born knowing everything.

Ron Okimoto